REMARKS

Favorable reconsideration and allowance of the present application are respectfully requested in view of the following remarks. Claims 1-6 have been amended and new claims 7-14 are added by this response. Therefore, claims 1-14 are pending in the present application.

Objections to the Specification

The Examiner has asserted that the title of the present application is not descriptive. The title has been amended to "FUEL CELL ELECTRICAL POWER GENERATION SYSTEM WITH FAST STARTUP" in response to the Examiner's objection.

In addition, the Examiner has objected to the specification for failing to provide proper antecedent basis for the claimed subject matter. Specifically, the Examiner contends that "first heat exchange means for performing heat exchange between the source gas and the oxygen-containing gas prior to their entry into the reformer" is not supported by the specification. The Applicants respectfully disagree. The Examiner appears to misread claim 3. The amended claim 3 recites "a heat exchange means for performing heat exchange between said source gas and said oxygen-containing gas prior to their entry into said reformer and said partial oxidation gas discharged out of said reformer". This feature is clearly disclosed in lines 8-11, page 26 and Figure 1 of the specification.

Thus, it is respectfully submitted that these objections should be withdrawn.

Claim Rejections Under 35 U.S.C. § 102

Claims 1, 4 and 6 are rejected under 35 U.S.C. § 102(e) as being anticipated by Haltiner, Jr. et al. (U.S. 2003/0235733; hereinafter "Haltiner");

Claims 1, 3 and 6 are rejected under 35 U.S.C. § 102(e) as being anticipated by Xu (U.S. 6,551,732; hereinafter "Xu");

Claims 1 and 3 are rejected under 35 U.S.C. § 102(b) as being anticipated by Matsui et al. (JP 2001-155747; hereinafter "Matsui");

Claims 1 and 3 are rejected under 35 U.S.C. § 102(b) as being anticipated by Kamiya (JP 2002-025588; hereinafter "Kamiya"); and

Claim 2 is rejected under 35 U.S.C. § 102(b) as being anticipated by Foger et al. (WO 01/13452; hereinafter "Foger"). These rejections are respectfully traversed.

Independent Claim 1

Independent claim 1 is directed to a fuel cell electrical power generation system. As amended, the system of claim 1 comprises:

a reformer through which an oxygen-containing gas and a source gas are flowed and which has a catalytic part for causing the partial oxidation of hydrocarbons contained in said source gas, and

a solid electrolyte fuel cell which is disposed downstream of said reformer and which has a cell main unit which includes: a fuel electrode which is supplied with a partial oxidation gas which contains hydrogen generated as a result of the flowing of said source gas and said oxygen-containing gas through said reformer; an oxygen electrode which is supplied with an oxygen-containing gas; and an electrolyte which lies between said fuel electrode and said oxygen electrode, wherein an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, and said fuel cell having a temperature that is below a minimum operating temperature.

Haltiner describes a solid-oxide fuel cell system, in which a fuel/air manifold conveys air and tail gas fuel from the anodes in a fuel cell stack assembly to a tail gas combustor, producing a heated combustor exhaust having the highest mass flow in the system. The exhaust is passed through a heat exchanger to warm incoming cathode reaction air, and the exhaust is partially cooled by the exchange. From the heat exchanger, the exhaust gas is passed through a tempering jacket space surrounding the fuel cells in the stack. The exhaust gas is used to externally heat and cool the stack (see Abstract, Haltiner). Haltiner neither discloses or suggests "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, and said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

Xu describes a fuel cell power system that includes a fuel cell for generating electricity that has a cathode, an anode, and a polymer electrolyte membrane. The fuel cell processes air through the cathode to yield a cathode effluent stream. The fuel cell power system further

includes a fuel processor for converting an inlet fuel stream of hydrogen and carbon containing fuels, utilizing a stream of oxygen containing gas and water vapor, to a processed fuel stream of hydrogen molecules for feeding into the fuel cell anode. The system then feeds a substantial portion of the cathode effluent stream to the fuel processor as the oxygen containing gas and water vapor for converting the fuel stream into hydrogen (see Abstract, Xu). Xu neither discloses or suggests "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, and said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

Matsui discloses a fuel cell system for supplying hot water prepared by waste heat accompanying generation of electricity that decreases the time required for starting a secondary burner by inhibiting generation of NOx due to the burning of the secondary burner. Specifically, the discharged gas from a hydrogen electrode of the fuel cell is supplied to a secondary burner upon starting the secondary burner. An electric heater is used to preheat gas. Thereafter, the secondary burner supplies city gas to continue to heat water (see Abstract, Matsui). Matsui does not discloses or suggests "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, and said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

Kamiya describes a fuel cell power generating device with a cooling condenser for cooling exhausted gas. The exhaust gas from the fuel cell power generation section is sent to a reformer, which reforms the original fuel with the heat of the exhausted gas discharged from the fuel cell power generation section. Furthermore, the exhausted gas is cooled by pre-heating a fluid for running the fuel cell power generating device with the exhausted fuel gas (see Abstract, Kamiya). Kamiya does not discloses or suggests "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, and said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

Independent Claim 2

Independent claim 2 is directed to a fuel cell electrical power generation system. The system of claim 2 comprises:

a reformer having a catalytic part which when a source gas is flowed therethrough converts hydrocarbons, contained in said source gas and having a carbon number equal to or greater than 2, into methane under the presence of hydrogen, and which when an oxygen-containing gas and said source gas are flowed therethrough causes the partial oxidation of hydrocarbons contained in said source gas, and

a solid electrolyte fuel cell which is disposed downstream of said reformer and which has a cell main unit which includes: a fuel electrode which is supplied with a hydrogen-containing gas; an oxygen electrode which is supplied with an oxygen-containing gas; and an electrolyte which lies between said fuel electrode and said oxygen electrode, wherein an electrode reaction of said hydrogen-containing gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte,

said fuel cell electrical power generation system performing:

a startup operation in which said source gas and said oxygen-containing gas are flowed through said catalytic part of said reformer, and a partial oxidation gas which contains hydrogen generated as a result of the flowing of said source gas and said oxygen-containing gas through said reformer is supplied to said fuel electrode as said hydrogen-containing gas, and

a normal operation in which said source gas is flowed through said catalytic part of said reformer and a fuel gas which contains methane generated as a result of the flowing of said source gas through said reformer is supplied to said fuel electrode.

Foger describes a process for producing electricity in a fuel cell. A higher carbon (C2+) hydrocarbon fuel reacts with steam in a steam pre-reformer at a temperature in the pre-reformer of no greater than 500 DEG C to produce a fuel stream including hydrogen and no less than about 20 % by volume methane measured on a wet basis. The fuel stream and an oxidant are supplied to a high temperature fuel cell in which the methane is reformed and electricity is produced by reacting the fuel stream at an anode of the fuel cell and reacting the oxidant at a cathode of the fuel cell (see Abstract).

However, Foger does not disclose or suggest a reformer causing a partial oxidation of hydrocarbons contained in a source gas when an oxygen-containing gas and the source gas are flowed therethrough. The Examiner asserts that Foger, in line 8, page 4 to line 14, page 5 and Figure 1, discloses such feature. Applicants respectfully disagree. Contrary to the assertion by the Examiner, the cited portion merely describes reacting hydrocarbon fuel with steam in a pre-

reformer to produce a fuel stream including hydrogen and methane. The fuel stream is then sent to a high temperature fuel cell to react with an oxidant. Nowhere in Foger is there a disclosure or suggestion of a reformer causing a partial oxidation of hydrocarbons contained in a source gas when an oxygen-containing gas and the source gas are flowed therethrough as in the present invention. With this arrangement, the present invention seeks to preheat the electrolyte by the heat held in the partial oxidation gas. Foger is not concerned with providing such feature and thus, cannot disclose or suggest "a reformer having a catalytic part which when a source gas is flowed therethrough converts hydrocarbons, contained in said source gas and having a carbon number equal to or greater than 2, into methane under the presence of hydrogen, and which when an oxygen-containing gas and said source gas are flowed therethrough causes the partial oxidation of hydrocarbons contained in said source gas" as recited in independent claim 2.

Furthermore, the Examiner asserts that the startup operation and the normal operation features of claim 2 are intended use and concludes that the fuel cell in Foger is capable of performing the claimed features. Applicants respectfully disagree. As discussed above, Foger does not disclose a reformer causing a partial oxidation of hydrocarbons contained in the source gas as in the present invention. Thus, contrary to the assertion by the Examiner, the fuel cell in Foger is incapable of performing "a startup operation in which said source gas and said oxygen-containing gas are flowed through said catalytic part of said reformer, and a partial oxidation gas which contains hydrogen generated as a result of the flowing of said source gas and said oxygen-containing gas through said reformer is supplied to said fuel electrode as said hydrogen-containing gas, and a normal operation in which said source gas is flowed through said catalytic part of said reformer and a fuel gas which contains methane generated as a result of the flowing of said source gas through said reformer is supplied to said fuel electrode" as recited in independent claim 2.

In view of the above remarks and amendments, it is respectfully submitted that none of the cited references anticipates independent claims 1 and 2. As claims 3, 4 and 6 are dependent on independent claim 1 or 2, it is respectfully submitted that these claims are also patentable for the same reasons discussed above with respect to independent claims 1 and 2. It is thus further respectfully submitted that this rejection should be withdrawn.

Claim Rejections Under 35 U.S.C. § 103

Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Matsui in view of Ogawa et al. (JP 59-098471; hereinafter "Ogawa"); and

Claim 6 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Matsui in view of Sakamoto et al. (JP 11-067256; hereinafter "Sakamoto"). These rejections are respectfully traversed.

Claim 5 is dependent on claim 1 or 2 and it is demonstrated above that claim 1 is distinguishable over Matsui. Ogawa does not remedy at least the above noted deficiencies of Matsui. Ogawa describes a fuel cell device, which is heated with a high temperature gas obtained through catalytic combustion of both fuel gas containing hydrogen and oxidizer gas containing oxygen. However, similar to Matsui, Ogawa fails to disclose or suggest "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

Claim 6 is dependent on claim 1 or 2 and it is demonstrated above that claim 1 is distinguishable over Matsui. Sakamoto does not remedy at least the above noted deficiencies of Matsui. Sakamoto describes a reformer including a partially oxidizing part for converting fuel into a hydrogen-rich reformed gas. A fan and a burner are operated to supply hot air to heat the partially oxidizing part, the CO modifying part and the CO selectively oxidizing part (see Abstract, Sakamoto). However, similar to Matsui, Sakamoto fails to disclose or suggest "an electrode reaction of said partial oxidation gas and said oxygen-containing gas is caused to take place in said fuel electrode, said oxygen electrode and said electrolyte, said fuel cell having a temperature that is below a minimum operating temperature" as recited in amended independent claim 1.

In view of the above remarks, it is respectfully submitted claims 5 and 6 are not made unpatentable by Matsui, Ogawa, and Sakamoto when taken alone or in combination (assuming these references can be combined, which Applicants do not admit). It is thus further respectfully submitted that this rejection should be withdrawn.

New Claims

Newly added claim 7 is dependent on claim 1 and it is respectfully submitted that the claim is also patentable for at least the same reasons discussed above with respect to claim 1.

The newly added independent claim 8 is directed to a method of generating fuel cell electrical power. The method of independent claim comprises the steps of:

converting hydrocarbons, contained in a source gas and having a carbon number equal to or greater than 2, into methane under the presence of hydrogen in a reformer when said source gas is flowed therethrough;

generating a partial oxidation gas which contains hydrogen by causing a partial oxidation of hydrocarbons contained in said source gas in said reformer when said source gas and an oxygen-containing gas are flowed therethrough;

causing an electrode reaction of a hydrogen-containing gas and said oxygen-containing gas in a solid electrolyte fuel cell, which is disposed downstream of said reformer and has a cell main unit which includes: a fuel electrode which is supplied with said hydrogen-containing gas; an oxygen electrode which is supplied with said oxygen-containing gas; and an electrolyte which lies between said fuel electrode and said oxygen electrode; and

performing a startup operation in which said source gas and said oxygen-containing gas are flowed through said reformer, and said partial oxidation gas is supplied to said fuel electrode as said hydrogen-containing gas and a normal operation in which said source gas is flowed through said reformer and a fuel gas containing said methane is supplied to said fuel electrode as said hydrogen-containing gas.

The applied prior art at least fails to disclose or suggest the claimed step of performing a startup operation in which said source gas and said oxygen-containing gas are flowed through said reformer, and said partial oxidation gas is supplied to said fuel electrode as said hydrogen-containing gas and a normal operation in which said source gas is flowed through said reformer and a fuel gas containing said methane is supplied to said fuel electrode as said hydrogen-containing gas. Newly added claims 9-14 are dependent on claim 8 and it is respectfully submitted that these claims are also patentable over the applied prior art for at least the same reasons discussed above with respect to claim 8.

CONCLUSION

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Dennis Chen Reg. No. 61,767 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.147; particularly, extension of time fees.

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Respectfully submitted,

By _____

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